Ultra-Compact Optical Spectrometer for Organic Mapping, uCOSOM (microcosm), Phase I

Completed Technology Project (2012 - 2012)

Project Introduction

We propose to develop a coke-can-size, 250 g, 400 mW instrument for mounting on small lander or rover arms: the ultra-Compact Optical Spectrometer for Organic Mapping (☐COSOM) instrument. Two core technologies enable the proposed instrument: a narrow linewidth, 235 nm, deep UV (DUV) semiconductor laser triode (LT), currently being developed by Photon System under DARPA funding; and a new uncooled, linear DUV CCD array detector with high quantum efficiency in the DUV with fast read rates and low read noise. The need for in situ micro-scale mapping for trace concentrations of organics on planetary surfaces is exemplified by requirements put forth the (July 09) Mid Range Rover – Science Analysis Group (MRR-SAG) and again in a 2010 Astrobiology paper by Pratt et al. ¿COSOM fulfills similar organic needs on future in-situ missions with MER class rover/arm sizes or small landers to planetary bodies such as Mars, icy worlds (Titan, Europa, Enceladus), and small primitive bodies. ☐COSOM provides a broad organic and inorganic compound measurement capability without the need for sample handling or reagents. It will excite sub-ppb levels of organic compounds on rocks, soil, or other surfaces at 235 nm and simultaneously measure Raman scattering in the 240 nm to 260 nm region (1000 to 4000 cm-1) and native fluorescence in the 260 nm to 700 nm region at a working distance of several cm, with long depth of focus, and with the ability to map areas up to 1 by 1 cm in size with 100 ☐m spatial resolution. The pulsed source enables solar blind gated Raman and fluorescence spectral measurements but also fluorescence and phosphorescence decay measurements to provide orthogonal information about target composition. The instrument can also provide spectral reflectance of targets from 240 nm to 700 nm together with Raman and fluorescence data, using solar illumination, and enable solar and stellar irradiance and sky background measurements.

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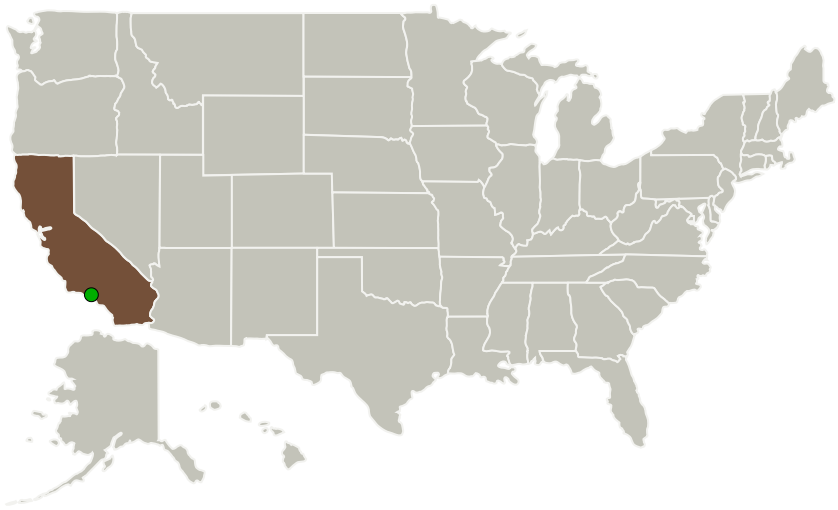
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Photon Systems, Inc.	Lead Organization	Industry	Covina, California
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations
California

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139822)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Photon Systems, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

William F Hug

Co-Investigator:

William Hug

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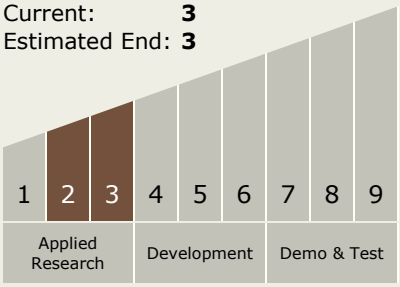
Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.2 Atomic and Molecular Species Assessment

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System